

ISMAIL J. RAMSEY (CABN 189820)
United States Attorney

MARTHA BOERSCH (CABN 126569)
Chief, Criminal Division

CHRISTIAAN HIGHSMITH (CABN 296282)
DAVID WARD (CABN 239504)
Assistant United States Attorneys

MATTHEW CHOU (CABN 325199)
Special Assistant United States Attorney

450 Golden Gate Avenue, Box 36055
San Francisco, California 94102-3495
Telephone: (415) 436-7200
FAX: (415) 436-7230
christiaan.highsmith@usdoj.gov
david.ward@usdoj.gov
matthew.chou2@usdoj.gov

Attorneys for United States of America

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

UNITED STATES OF AMERICA,)	CASE NO. 20-CR-00249 RS
Plaintiff,)	
v.)	UNITED STATES' DISCLOSURE OF
)	REBUTTAL EXPERT TESTIMONY BY
ROWLAND MARCUS ANDRADE,)	COMPUTER SCIENTIST DR. MATTHEW J.
)	EDMAN
Defendant.)	Trial: Feb. 10, 2025 9:00 a.m.
)	Court: Courtroom 3 17th Floor
)	Judge: Hon. Richard Seeborg

CONTENTS

I.	INTRODUCTION	1
II.	EXPERT’S BACKGROUND AND QUALIFICATIONS.....	1
III.	EXPERT OPINIONS	3
A.	The documents Mr. Min relied upon in forming his opinions regarding the purported development of AML Bitcoin are unreliable and insufficient to substantiate those opinions.	3
B.	Mr. Min’s testimony “that nearly 16.5 million lines of code were committed and used for development in the remaining AML Bitcoin repositories” and that such code “is reflective of at least 18-24 months’ of work performed by qualified and intelligent developers” is speculative, inaccurate, and misleading.	6
C.	Mr. Min’s testimony that “AML Bitcoin was substantially close or fully developed before the project was ended” is speculative and wholly unsupported by the evidence Mr. Min relied on.	8
IV.	EXPERT’S APPROVAL AND SIGNATURE ON DISCLOSURE.....	11

I. INTRODUCTION

The United States hereby discloses, pursuant to Federal Rule of Criminal Procedure 16(a)(1)(G) and Federal Rule of Evidence 702, the expert testimony of computer scientist Matthew J. Edman, Ph.D., which the United States may offer in the trial of this case. The United States intends to call Dr. Edman to rebut the proffered testimony of defense expert Erik Min. Mr. Min reviewed what purports to be “source code and databases associated with AML Bitcoin,” Dkt. 448 at 2 (Min Disclosure), that were produced to the government on about January 22, 2025. *See* Dkt. 503 ¶¶ 8–14 (US Mot. for Complete Min Disclosure); Dkt. 521 (order granting and denying in part Dkt. 503). The United States therefore provides the disclosure noted below. The United States may supplement or amend Dr. Edman’s disclosures in response to supplemental opinions offered by Mr. Min—such as ones pertaining to AtenCoin that the Court has ordered the defense to disclose by February 5, 2025, *see* Dkt. 521 at 2–3—or if Dr. Edman becomes aware of additional information relevant to the opinions disclosed herein.

II. EXPERT’S BACKGROUND AND QUALIFICATIONS

1. Dr. Edman is a Partner and Co-Founder of NAXO Labs LLC (“NAXO”), a cybersecurity and investigations firm located in New York, NY, specializing in crypto assets and digital forensic investigations. Dr. Edman’s education, training, and professional experience, as explained below, as well as his analysis of the materials cited herein, fully qualify him to offer the expert opinions contained in this disclosure. A copy of Dr. Edman’s *curriculum vitae* is attached as **Exhibit 1**.

2. Dr. Edman holds the following academic degrees: (a) Ph.D., Computer Science, Rensselaer Polytechnic Institute (2011); (b) M.S., Computer Science, Rensselaer Polytechnic Institute (2007); and (c) B.S., Computer Science, Baylor University (2005). His professional training includes the following industry-recognized certifications related to cryptocurrency investigations: Chainalysis Reactor Certification (“CRC”), Chainalysis Ethereum Investigations Certification (“CEIC”), and Chainalysis Investigation Specialist Certification (“CISC”). Dr. Edman also holds a AccessData Certified Examiner (“ACE”) credential, which is a certification recognized in the field of digital forensics.

1 3. In addition to his education and training, Dr. Edman has reviewed source code
2 professionally for over 15 years and has over a decade of professional experience conducting
3 cryptocurrency and digital forensic investigations.

4 4. From 2009 to 2013, Dr. Edman was employed as a Lead Cyber Security Engineer at The
5 MITRE Corporation where he primarily supported the FBI's Remote Operations Unit in Quantico, VA,
6 on various matters related to the investigation of darknet marketplaces and other illicit uses of crypto
7 assets. He led the technical efforts to identify the technical infrastructure hosting the Silk Road
8 marketplace, which was a darknet marketplace that facilitated the sale of drugs and other illicit items in
9 exchange for Bitcoin.

10 5. From 2013 to 2014, he was employed as a Senior Vulnerability Engineer by Bloomberg,
11 LP, a global financial services, software, and media company. As a member of the firm's Vulnerability
12 Analysis Team, Dr. Edman's responsibilities included source code reviews, design reviews, penetration
13 testing, and "red team" analysis of the firm's internal and third-party applications, networks, and
14 websites.

15 6. From 2014 to 2015, Dr. Edman was employed as a Senior Director in FTI Consulting,
16 Inc.'s Global Risk and Investigations Practice in the Cyber Security & Investigations Group. His work
17 included conducting cryptocurrency investigations and digital forensic analysis for multiple clients,
18 including for the U.S. Attorney's Office for the Southern District of New York.

19 7. From 2015 to 2022, Dr. Edman was employed by Berkeley Research Group, LLC
20 ("BRG"), a global strategic advisory and expert consulting firm, as a Director in BRG's Cyber
21 Operations & Incident Response practice where he regularly provided expert consultation to clients
22 regarding the investigation and analysis of addresses and transactions related to numerous different
23 crypto assets, including Bitcoin and Ethereum.

24 8. Since co-founding NAXO in 2022, Dr. Edman has testified as an expert in the fields of
25 blockchain analysis and source code review in the United States District Court for the Southern District
26 of New York, including most recently in the matter of *Securities and Exchange Commission v. Terraform*
27 *Labs Pte. Ltd. and Do Hyeong Kwon* (1:23-cv-01346-JSR). A summary of his prior testimony is
28 included in Exhibit 1.

1 III. EXPERT OPINIONS

2 9. If called as a witness at trial, Dr. Edman could testify as an expert regarding the following
 3 opinions he has formed after reviewing: (i) the pleadings in this case; (ii) the disclosures submitted by
 4 the Defendant's proposed cryptocurrency expert, Mr. Erik Min (Dkt. 448); (iii) the materials Mr. Min
 5 provided in connection with those disclosures; (iv) the AML Bitcoin Whitepaper;¹ (v) interview reports
 6 of AML Bitcoin developers who are expected to testify at trial; and (vi) any other materials cited herein
 7 which Dr. Edman relied on in forming his expert opinions.

8 A. The documents Mr. Min relied upon in forming his opinions regarding the 9 purported development of AML Bitcoin are unreliable and insufficient to substantiate those opinions.

10 10. The opinions disclosed by Mr. Min rely on his² analysis of certain "source code and
 11 databases associated with AML Bitcoin." (Min Discl. at 2.) Based on that analysis, Mr. Min concludes
 12 that "there is evidence of consistent and substantial development work conducted prior to late 2018" and
 13 that "timestamps and other records show[] substantial and consistent development of the underlying
 14 biometric verification software (and associated web and mobile applications) between March 2017 and
 15 November 2018." (Min Discl. at 4.)

16 11. Dr. Edman will testify that based on his review of the materials relied on by Mr. Min, Mr.
 17 Min's conclusions regarding when certain source code was created or modified are based on data that is
 18 incomplete, cannot be reliably verified, and would not generally be relied on by other experts to offer an
 19 opinion as to on when certain source code was developed.

20 12. Mr. Min's disclosures make repeated reference to "numerous source code repositories"
 21 stored on "'BitBucket,' a cloud-based platform that enables teams of developers to write and store
 22 source code" and other files. (Min Discl. at 3.) Dr. Edman will testify that software developers and
 23 development teams frequently use a computer program called "Git" to create, store, access, modify, and
 24

25 ¹ There are several versions of the White Paper, and they are similar. Dr. Edman has so far
 26 reviewed a version designated "v1.1" that Mr. Andrade emailed on October 4, 2017. *See*
 ANDRADE_DOJ_00022158 (email); ANDRADE_DOJ_00022160 (White Paper).

27 ² Mr. Min's expert disclosures conspicuously only reference "FTI's" analysis of certain source
 28 code which Mr. Min relied on in forming his opinions (*see*, generally, Min Discl. at 2-4, 7-8), but his
 disclosures do not make clear what, if any, Mr. Min's role was with respect to "FTI's" analysis.

1 share source code in “BitBucket repositories,” as Mr. Min refers to them. Dr. Edman’s testimony will
2 describe how: (i) a Git “repository” is a collection of related source code and other files managed by the
3 Git software, including source code stored on the BitBucket platform, and contains a record of historical
4 changes made to the files in the repository; (ii) a group of changes made to one or more files in a Git
5 repository (e.g., adding, deleting, or modifying files in the repository) is called a “commit;” (iii) each
6 commit in a Git repository also has certain metadata associated with it, including identifying information
7 about who created each commit (e.g., a username and/or email address), when the commit was made,
8 which files were affected by the commit and any changes made to those files, and, optionally, a
9 summary (or “commit message”) describing the nature or purpose of those changes; and, (iv) the source
10 code and associated metadata are stored in a Git repository in a manner that allows users to verify the
11 integrity of the data in the repository.

12 13. Dr. Edman will testify that, based on his review of the materials Mr. Min provided in
13 connection with his disclosures, only four out of over 60 source code “repositories” provided to the
14 Government by Mr. Min contained Git commit history information,³ despite data which showed that
15 many of those repositories were previously stored on BitBucket in a Git repository format. Dr. Edman
16 will testify that of the four source code repositories provided by Mr. Min which did, in fact, contain
17 historical Git records, those records indicate that the earliest commit was to the “aml-bgcwallet”
18 repository which occurred on or about January 7, 2019, and that the last commit to that repository
19 occurred in March 2021. Dr. Edman will also describe his analysis which found that the remaining three
20 repositories were not created until on or about April 2, 2019, and did not reflect any development
21 activity after October 2019.

22 14. Dr. Edman will also testify that a fifth source code “repository” provided by Mr. Min
23 (“androidapp”) contains only partial Git repository information. Dr. Edman will describe how the Git
24 software stores repository information in a standard, well-defined format, which includes historical
25 records (or “logs”) regarding the timeline of changes to the repository. Dr. Edman explain that the
26 “androidapp” source code repository provided to the Government by Mr. Min did not include the
27

28 ³ Dr. Edman will testify that the only source code repositories provided by Mr. Min which
contained Git commit history were: “aml-bgcwallet,” “corda,” “crossverify-ui,” and “mvp.”

1 repository's "logs" file, among other standard Git repository information, and that the absence of such
2 standard Git repository information suggests that the data was corrupted or otherwise manipulated to
3 remove its historical record of changes. In either instance, Dr. Edman will explain, the data relied on by
4 Mr. Min is incomplete and unreliable.

5 15. The remaining source code files on which Mr. Min relies, Dr. Edman will testify, were
6 simply produced as a number of individual "zip" files containing "snapshots" of source code and other
7 files from an unknown point in time, with no description regarding how those snapshots were created,
8 obtained and validated by Mr. Min, and which did not contain reliable historical records and other
9 metadata expected to be found in a Git repository. Dr. Edman's will also testify to his analysis which
10 found that some of the snapshots of the "BitBucket repositories" Mr. Min provided did not contain any
11 source code at all, including a snapshot purportedly representing the source code for the Aten Coin
12 blockchain ("amlbitcoin-aml-atencoinblockchain-476cb6129d9e").

13 16. Consequently, as Dr. Edman will explain, without verifiable historical information, Mr.
14 Min's opinions regarding when certain software was created or modified are speculative and based
15 largely on data that can be easily manipulated (e.g., much like editing a text file using Microsoft
16 Notepad). Dr. Edman will testify that while it is reasonable and common for an expert to analyze the
17 *functionality* of software by reviewing its source code, Dr. Edman will also testify that an expert would
18 not normally be able provide an opinion as to *when* certain source code was developed and over what
19 time period without having accurate and reliable records of changes made to that source code. Dr.
20 Edman will explain that relying on "comments" left by developers in the source code is not a reliable
21 method of determining when that source code was created.

22 17. As Dr. Edman will testify, experts in source code analysis would typically rely on a
23 historical record of changes to software source code (e.g., commits to a Git repository) to form opinions
24 regarding when that source code was developed. In addition to it being unusual for an expert to provide
25 an opinion as to the development timeline of source code without a historical record of changes to that
26 source, Dr. Edman will testify that it would also be very unusual for software development "teams" to
27 develop, share, or store that source code stored in the manner in which Mr. Min reviewed them (i.e., as a
28 series of "zip" files without a record of changes to the source code). To the contrary, Dr. Edman will

1 explain how the typical means of accessing (or “cloning”) a Git repository creates a replica of not just
2 the source code in that Git repository, but also the metadata and other commit history within that
3 repository, which enables both software developers and source code reviewers to reliably review and
4 manage changes to that repository.

5 18. Dr. Edman will opine that, in addition to “cloning” a repository, another common and
6 reliable format used to obtain and analyze a Git source code repository is a Git “bundle.” Dr. Edman’s
7 testimony will state that a Git bundle is a standard, commonly used format created by the Git software,
8 which packages an entire repository into a single file (or “bundle”) and contains a complete backup of
9 the repository as of a particular date or commit. Dr. Edman will testify that he has previously reviewed
10 and analyzed Git bundles produced in connection with recent litigation in which he testified as an expert
11 at trial.

12 **B. Mr. Min’s testimony “that nearly 16.5 million lines of code were committed and used**
13 **for development in the remaining AML Bitcoin repositories” and that such code “is**
14 **reflective of at least 18-24 months’ of work performed by qualified and intelligent**
15 **developers” is speculative, inaccurate, and misleading.**

16 19. Mr. Min disclosed that he intends to testify at trial that “nearly 16.5 million lines of code
17 were committed and used for the development in the remaining AML Bitcoin repositories reviewed by
18 FTI.” (Min Discl. at 7.) Based on Mr. Min’s review of that source code, Mr. Min concluded that “the
19 quality and sophisticated nature of the source code reviewed by FTI is reflective of at least 18-24
20 months’ worth of concentrated work performed by qualified and intelligent developers.” (*Id.*) Dr. Edman
21 has reviewed the source code and other materials provided to the Government by Mr. Min and formed
22 the following opinions.

23 20. First, Dr. Edman will testify that it is not clear from Mr. Min’s *curriculum vitae* what, if
24 any, specialized education, training, or professional experience Mr. Min has that would qualify him to
25 evaluate the “the quality and sophisticated nature” of computer source code, opine as to whether its
26 developers are “qualified and intelligent,” or quantify the level of effort it would take to develop that
27 source code.

28 21. Second, after reviewing Mr. Min’s disclosures and the source code he relied on, Dr.
Edman will testify that Mr. Min provides no reliable bases for his assertion that “nearly 16.5 million

1 lines of code were committed” to the “AML Bitcoin repositories.” (Min Discl. at 7.) Dr. Edman will
2 opine that Mr. Min failed to provide a description of the tools or the methodology he used to reach that
3 conclusion, and that Mr. Min has overstated the actual number of lines of code by including data that
4 experts would typically omit, such as documentation files, log files, lines representing non-functional (or
5 “commented out”) code, and even blank lines containing no code whatsoever.

6 22. Third, Dr. Edman will testify that even if one accepted Mr. Min’s opinion as to the number
7 of lines of code in the “AML Bitcoin repositories,” Mr. Min’s opinion that such code “is reflective of at
8 least 18-24 months’ of work performed by qualified and intelligent developers” is speculative,
9 misleading, and unsupported by the evidence relied on by Mr. Min. Dr. Edman’s own analysis
10 determined that much of the code Mr. Min appears to rely on comprises code that was written by
11 unrelated third parties and copied into the “AML Bitcoin repositories.” That code, in Dr. Edman’s
12 opinion, does not support Mr. Min’s assertion that the source code reflects “substantial and consistent
13 development of the underlying biometric verification software (and associated web and mobile
14 applications).” (Min Discl. at 4.)

15 23. Finally, Dr. Edman will testify based on his own analysis and professional experience
16 reviewing source code that the remaining source code does not support Mr. Min’s opinion that it reflects
17 “concentrated work performed by qualified and intelligent developers.” (Min Discl. at 7.) On the
18 contrary, as Dr. Edman determined, the source code which was *not* copied from third party software
19 projects was substantially incomplete or non-functional, reflective of minimal or unskilled development
20 effort, and largely contradictory to Mr. Min’s opinion that the source code reflects “substantial and
21 consistent development of the underlying biometric verification software.” (Min Discl. at 4.)

22 24. For example, Dr. Edman’s analysis determined that the source code snapshot purporting to
23 represent a version of the “AML Bitcoin” blockchain software (“amlbitcoin-amlwallet-77a028e6d3be”)
24 was actually a “fork” of the source code for the original Bitcoin software (“Bitcoin Core”⁴). Dr. Edman
25 will explain that a fork is essentially a copy of the source code for an existing blockchain, but with
26 differences that make it incompatible with the original (i.e., “pre-fork”) blockchain.

27
28

⁴ Bitcoin Core, <https://web.archive.org/web/20250127095517/https://bitcoin.org/en/bitcoin-core/>
USA DISCLOSURE OF REBUTTAL EXPERT TESTIMONY BY COMPUTER SCIENTIST, DR. EDMAN
20-CR-00249 RS

25. Dr. Edman will describe his comparison of the source code for the “AML BitCoin” blockchain and the Bitcoin Core blockchain, which found that the “AML BitCoin” source code did not include any changes reflecting the “development of the underlying biometric verification software” Mr. Min referenced in his disclosures. (Min Discl. at 4.) Further, Dr. Edman will testify that the “AML BitCoin” fork was likely created no earlier than February 2018 due to references in the source code to the headline of a news article published in or around February 2018.⁵

26. Based on his review of the source code, Dr. Edman will testify that the “AML Bitcoin” blockchain source code was likely created by automatically replacing references to “Bitcoin” in the source code with references to “AML BitCoin” (e.g., “Bitcoin Core” became “AML BitCoin Core”). Dr. Edman will testify that the minimal and unskilled effort in which the “AML Bitcoin” fork was created resulted in references to website domains and source code repositories that did not exist based on his review of historical records from sources including DomainTools⁶ and the Internet Archive.⁷

C. Mr. Min’s testimony that “AML Bitcoin was substantially close or fully developed before the project was ended” is speculative and wholly unsupported by the evidence Mr. Min relied on.

27. Mr. Min’s expert disclosures state that he intends to testify that “AML Bitcoin was substantially close or fully developed before the project was ended” and that “transaction data on AML Bitcoin’s Hyperledger Fabric blockchain” suggested “the [AML Bitcoin] project was completed around” April 2020. (Min Discl. at 8.) As a basis for his opinion, Mr. Min cites FTI’s review of “various pieces of software that comprised [*sic*] AML Bitcoin cryptocurrency,” which purportedly included, “data collection functions of AML Bitcoin that were labeled ‘CrossVerify’” and “mobile applications for identity verification.” (Min Discl. at 3-4.) Mr. Min also cited “verification logs” associated with “CrossVerify’s biometric data collection and authentication features” as a basis for concluding that “development began on integrating CrossVerify’s biometric technology with blockchain technology by at least March 23, 2018.” (Min Discl. at 5.)

⁵ *SUV’s accelerator sticks at speeds up to 100 mph*, FOX 5 New York (Published: February 14, 2018). <https://web.archive.org/web/20200812150336/https://www.fox5ny.com/news/suvs-accelerator-sticks-at-speeds-up-to-100-mph>

⁶ DomainTools, <https://web.archive.org/web/20250128114550/https://www.domaintools.com/>

⁷ Internet Archive Wayback Machine, <https://web.archive.org/>

28. Dr. Edman, after reviewing the source code, transaction data, “verification logs,” and other data relied on by Mr. Min, will testify to his expert opinion that they (1) are not indicative of a blockchain that “integrated biometric identification technology with blockchain technology” (Min Discl. at 5); (2) did not require “a user to confirm their identity using data before the transaction was approved” (Min Discl. at 3); and (3) were not “substantially close,” “fully developed,” or “fully functional.” (Min Discl. at 8.) Instead, Dr. Edman will testify, based on his analysis of the source code provided by Mr. Min, that Mr. Min’s opinions rely almost entirely on his speculation regarding the functionality of “certain third-party software (including certain libraries and ‘APIs’),” which Mr. Min concedes was not within the scope of his review. (*Id.*)

29. Dr. Edman will testify that the “verification logs” relied on by Mr. Min are contained within a simple text file (“CrossVerifyDB.sql”) created by saving (or “exporting”) the contents of a database to a file. Dr. Edman will testify that the exported “verification logs” which Mr. Min relied on are derived from a standard, centralized database and do not reasonably demonstrate any integration with a blockchain that “required a user to confirm their identity using data before the transaction was approved.”

30. Dr. Edman will offer his expert opinion that the “mobile applications for identity verification” do not, in fact, implement any biometric verification either. Instead, as Dr. Edman will testify, the applications essentially allowed users to take a “selfie” using their mobile device’s camera, which was then uploaded to a web server. Dr. Edman will testify that the Android application associated with the “verification logs” Mr. Min relies on, in particular, appears to have been based in part on an application for overlaying large, cartoonish (or “googly”) eyes on the face of the mobile phone user. Dr. Edman will also describe his review of the source code for both the purported Android and iOS “mobile applications for identity verification.” Dr. Edman’s review found that the applications are incomplete and that neither, in fact, implemented any biometric verification or integration with a blockchain.

31. Dr. Edman will also testify to his review of the source code for the “backend” application relied on by the mobile applications. He found that the backend, too, operated like a typical, centralized web application and did not implement any biometric verification or integration with a blockchain. Instead, Dr. Edman’s analysis determined that the application would simply rely on other traditional

1 (i.e., non-blockchain) web applications to purportedly conduct some biometric verification, which Mr.
2 Min acknowledged was not available for his review. Similarly, Dr. Edman will testify, the backend
3 application relied on other traditional (i.e., non-blockchain) web applications to purportedly integrate
4 with a blockchain, which *also* was not available for Mr. Min to review.

5 32. Finally, Dr. Edman will explain that the “Hyperledger Fabric blockchain that recorded
6 AML Bitcoin transactions” referenced by Mr. Min is distinct from and incompatible with the “AML
7 BitCoin” software forked from the Bitcoin blockchain in or around February 2018. Dr. Edman will
8 testify regarding his review of the databases associated with the purported “AML BitCoin” blockchain,
9 which Mr. Min relied on to suggest “the project was completed around [April 2020].” (Min Discl. at 8.)
10 While Dr. Edman will testify that he determined the Hyperledger Fabric databases reflect blockchain
11 transactions that purportedly occurred in or around April 2020, Dr. Edman will testify that those
12 transactions are unrelated to the “verification logs” and associated “mobile applications for identity
13 verification” that Mr. Min based his opinions on. The Hyperledger transactions do not show that the
14 purported integration of biometric verification into blockchain transactions was “substantially close or
15 fully functional,” as Mr. Min intends to testify. (*Id.*)

16 //

17 //

18 //

19 //

20 //

21 //

22 //

23 //

24 //

25 //

26 //

27 //

28 //

IV. EXPERT'S APPROVAL AND SIGNATURE ON DISCLOSURE

Pursuant to Federal Rule of Criminal Procedure 16(a)(1)(G)(v), I, Matthew J. Edman, approve my expert witness disclosure, which contains my expected testimony to counter testimony that the defendant has disclosed.

DATED: February 5, 2025



MATTHEW J. EDMAN
Partner and Co-Founder
NAXO Labs LLC
45 Rockefeller Plaza, Suite 1964
New York, NY 10111

DATED: February 5, 2025

Respectfully submitted,

ISMAIL J. RAMSEY
United States Attorney

/s/
CHRISTIAAN HIGHSMITH
DAVID J. WARD
Assistant United States Attorneys

MATTHEW CHOU
Special Assistant United States Attorney